The Afghanistan Engineering Support Program assembled this deliverable. It is an approved, official USAID document. Budget information contained herein is for illustrative purposes. All policy, personal, financial, and procurement sensitive information has been removed. Additional information on the report can be obtained from Firouz Rooyani, Tetra Tech Sr. VP International Operations, (703) 387-2151.

TETRA TECH

MEMORANDUM

To: [redacted]

Fr: Tetra Tech

Re: **Extension of the Kabul Water Supply System**

Dt: January 17, 2010

Tetra Tech reviewed the "Feasibility Study for the Extension of the Kabul Water Supply System" report, prepared on January 2004, presented by "Beller Consult GmbH" and "Kocks Consult GmbH" in co-operation with "Stadtwerke Ettlingen GmbH", all three well established firms from Germany. The report was prepared in Kabul and in Germany with the contributions of the JV's Afghan staff and staff from Central Authority for Water Supply and Sanitation (CAWSS).

Socio-economic, Technical Assessment and Problem Analysis

Population estimates: At the time of the study, there was not valuable statistical data collected after the 1979 census and the 1986 survey for Kabul, 2003 census numbers were anticipated. The conclusion validated the 2002 Kabul population of 1,865,000 inhabitants. Target population projections were estimated at 3,042,000, 3,527,000, and 4,088,000 for 2005, 2010, and 2015 respectively with an assumed natural growth rate of 3.0 % after 2005.

The global target expressed in the report summary appears to consider a growth rate in the population over time and provide for adequate water supply for said population.

Water consumption: There was no data available on the present water residential or commercial consumption. The household survey and the present production showed that the population covered most of the water demand from sources other than the distribution network. The conclusion was that local aquifers would not be capable of meeting the City's requirements even until the target year 2010.

The fact that the existing system is not metered contributes to the lack of accurate information on current household usage. An increasing block water rate was recommended to be established, which more closely matches the costs involved in providing the water service.

Inaccuracies in census data or population projections could have an adverse effect on the ability of the water supply to meet the demands of the population.

Water Supply: The water supply system of Kabul is made up of several distinct parts:

The Kabul water supply system that was inspected in late April 2003 consisted of the following elements, in the order of importance: Logar system, Allaudin system, Afshar system, Nasaji system, Microroyan system and some minor systems.

Some of the network predated 1975, most was installed between 1976 and 1985, and some was installed after 1996. A total of 27 km was proposed to be replaced under the IAP. The present status of the distribution network is still unknown. Systematic leak detection could not be carried out at that time due to lack of water.

To adequately determine the condition of the existing piping network, leak detection is critical. It appears that a major portion of the existing distribution systems are "new" in terms of relative pipe age, which supports the contention that the leak detection can be invaluable.

Groundwater investigation: The hydrogeological considerations and the assessment of groundwater hydraulics established by the Consultant were based on studies conducted prior to 1996. Deficits of production were recognized.

The document that Consultant used on surface water resources was the "Kabul River Valley Development Project". This document covers the entire Kabul River basin and analyzed a series of major hydraulic projects such as several dams, irrigation, power and potable water supply to the City of Kabul. In an economically justified ranking of projects, the Gat dam emerged as the most favorable project. In a brief calculation, it was determined that the dam project could provide sufficient water to satisfy the low needs of potable water to Kabul with a number of caveats. However, it was determined that the project required urgent updating. Apart from the Consultant's own site visits, information on the actual environmental situation in Afghanistan was taken from the 'Post-Conflict Environmental Assessment'34 carried out by UNEP in 2002 and published in February 2003.

Regarding the development of additional supply through the dam project, the adequacy of the source of the supply is a critical factor in the success of the Kabul Water Project.

Possible options and concepts

Stage 1 of the report has shown that the water resources that are nearby and referred to as 'local' resources are not sufficient to meet the demand of the present and future population. In fact, these resources can serve only up to approximately 2 million inhabitants.

The project (based on 2003 or earlier data) aimed at distributing the locally and readily available water; production beyond this threshold required other resources which were distant or not readily available.

Since local resources are inexpensive in comparison to other alternatives, the staged approach suggested mobilizing these resources in a Short Term project. The other resources were to be developed later. The Short Term project integration with future expansion would need to be the subject of a future feasibility study.

Also, with regard to the large investment cost involved, the project was conceived to allow packaging and stepwise implementation.

It must be emphasized that implementation has to follow the direction of flow of the water. This means that the headwork's (well fields, high-lift pumping stations, trunks and reservoirs must be completed and be operational prior to the works in the distribution networks).

Preliminary Design and Feasibility Study on Short Term Project

Resources

The resources in use and those serving the project are identical. These are aquifers recharged by the rivers of the area: the Logar river, the Kabul river and the Paghman river. No surface water is now currently, nor is it forecasted in the project.

Production

Of the three well fields, Logar, Allaudin and the (new) Upper Kabul, a total of 26 new wells are proposed to be drilled and equipped, which would increase the average and peak day capacities of the Kabul Water System to 121,000 and 171,000 m3/d, respectively.

The quality of the water of the four main aquifers is still in accordance with WHO requirements; it is expected that this quality can be maintained in the future provided that the well filed protection areas are respected.

In water system development of this magnitude, a disinfection system must be considered and implemented. This issue is not addressed in the report.

Pumping Station, Reservoirs and Trunks

The well fields were allocated to reservoirs in a way to minimize transport of water across the city. Three new pumping stations were proposed at Logar, Upper Kabul and Afshar and the existing Bagrami and Allaudin pumping stations must be enlarged and upgraded, respectively.

Stand-by power generation was not included but was rather dealt with in one of the complementary projects.

Trunk mains were provided from the pumping stations to the respective reservoirs. Many main reservoirs were proposed to be integrated in the project, 6 new reservoirs are required to cover the supply areas that cannot be served by the existing ones. Since the project's capacity cannot satisfy the demand, reservoir capacities of the project are compared with those required at saturation of the supply areas and appropriate staging is provided.

This is a feature which will enable future operators of the systems to perform regular readings and compare output from the reservoir with consumption within the district fed by said reservoir.

Distribution

The distribution network with diameters equal and below DN200 was increased from approximately 450 km by 925 km to 1,375 km and covered an area of 8,000 ha with a total population of approximately 2.0 Mcap where from 1.39 Mcap are served by house connections.

It should be noted that a distribution system made up of these pipe sizes will not have the capacity to deliver adequate fire-flow volumes.

Accompanying Measures

Training measures are required to build up the required capacities with CAWSS's staff. An operational plan for such training measures has to be established and be implemented

by interested parties. Simultaneously with the implementation of the project a reform of the water sector is required to safeguard an orderly management of the scarce water resources and to resolve the imminent conflicts on water allocation.

Complementary Measures

In the presence of a nightsoil system for excreta and the absence of an operating drainage system in Kabul, the continuous improvement of on-site sanitation is required. This may require a strengthening of the nightsoil removal system and the construction of cess-pools on all plots for the removal of grey sewage.

Improved sanitation systems will become more of an issue as the availability of water increases.

Another complementary measure is the preferential treatment of the 4 principal stations and their well fields concerning power supply. This may require stand-by or continuous power generation for these stations.

Cost Estimation and Financial Analysis

Global quantity contingencies are set at 5%. Global cost of consultancy services is set at 10% of the value of the completed works, excluding special investigations. Global price contingencies are set at 5% only taking into consideration that international inflation is low at present and is expected to remain so, not exceeding 1% per year.

At this stage of a project's development/design the cost contingency should be greater than 15%.

Likewise, the bill collection ratio is expected to increase from 60 % in 2004 up to 80 % in 2010 as a result of the new systems and the awareness campaigns running throughout the implementation period.

Conclusion

The 2004 Study was based on dated or incomplete information. Further study was suggested in the report. It is unknown if such studies were conducted prior to Implementation.

Several issues raised could be improved upon to result in an improved system:

2. Disinfection of the water being supplied to the system should be considered.

3. Redundant pumps at every new pumping facility.

4. Stand-by power generation at all pumping facilities.

Regarding cost, risk and environmental impacts of the project, the authors of the study said it best:

The cost estimates are tentative and may be subject to strong variations when the project comes to tendering, because for more than two decades no project of comparable kind and size has been executed in Afghanistan. The prices reflect the 2003 level of international contractors. The appropriateness of contracting parts of the works to national Afghan contractors must be evaluated as the implementation proceeds.

The activities indicated above will lead to the stipulated intermediate results and the latter will be determinant for reaching the project and the overall objectives under the conditions and hypotheses set forth. There exists however the risk that this will not work as expected. This risk is seen as being of political nature. New political factors could create an unfavorable environment for the application or the effectiveness of the proposed measures. Or, worse, activities and achievements could be directly forbidden or annihilated. There exists also the risk of poor economic development in Kabul, where partly extremely poor returnees are resettling, to an extent which is almost impossible to predict. Such a scenario would result in a bill collection ratio being below forecast. Finally there remains a risk of a prolongation of the sequence of dry years, comparable to that experienced during the impounding period of large dams.

No immediate negative environmental impact can be associated with the project. Withdrawal of the total of 44 Mm^3 per year (= 1.4 m^3/s) from the Kabul river affects the stretch in the gorge down to the confluence of the Panjsher. This withdrawal also affects power generation in the power stations downstream of Kabul; the loss may reach up to 44 GWh/a. Both issues have to become subjects of future study of the Kabul River basin, the water supply to Kabul city being only one of the various users of the Kabul river.

In conclusion, the report as a whole is well organized, thorough and detailed, and with the exception of the few items identified above, will result in a significant increase in the quality of life in Kabul.